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AUTHOR Ireton, Harold R.
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ABSTRACT

The Child Development Inventory (CDI), a restandardized version of the Minnesota Child Development Inventory, is completed by parents to measure the developmental progress of their children ages 15 months to 6 years or children judged to be functioning in that age range. It measures present development in eight areas: social, self-help, gross motor, fine motor, expressive language, language comprehension, letters, and numbers. It also measures parents' concerns about the child's vision and hearing, health, and growth as well as development. It includes items to measure various behavior and emotional problems of young children, and an index of overall development. The CDI was standardized on a sample of 568 children ages 1-6 from South Saint Paul, Minnesota, a 95% white working class community. The CDI's validity was determined by examining results for norm group children at younger and older ages, by comparing their CDI results to psychological test results, and by examining CDI results for children with developmental and other problems. Data indicate that parents' CDI reports correlate with children's age, with children's achievement of reading and math skills in kindergarten, and with placement in early childhood special education. For children with chronic illnesses, the CDI results suggest relationships between their health problems and their development and adjustment. An appendix contains descriptions of child development inventories related to the CDI. (Contains 15 references.) (JDD)

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Child Development Inventory Assessment of Children's Development, Symptoms, and Behavior Problems

Harold R. Ireton[1]

University of Minnesota
Health Sciences Center

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[1]All correspondence should be sent to Harold R. Ireton, Department of Family Practice, University of Minnesota, Box 381 UMHC, 6-240 Philips-Wangensteen Building, 516 Delaware ST SE, Minneapolis, MN, 55455.

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ABSTRACT

The Child Development Inventory (CDI) is a standardized method of obtaining parents' reports of children's present development, adjustment, and symptoms. CDI reports were studied in a normative sample of one to six year olds, (N=568). The CDI developmental scales were found to correlate with age as follows: social .81; self-help .84; gross motor .81; fine motor .84; expressive language .83; language comprehension .84; letters .70; numbers .83; general development .89. For kindergarten children, (N=132), the general development, letter, number, language comprehension, and expressive language scales correlated with achievement in reading, (Median r. 56), and math, (Median r. 49). For children enrolled in early childhood/special education, (N=26), seventy-three percent showed delayed range CDI profiles, while the remaining children were reported to have one or more symptoms or behavior problems. Children with chronic illnesses, (N=24), were reported to have a variety of symptoms and behavior problems.

KEY WORDS: Child, Development, Inventory, Assessment, Validity.

CHILD DEVELOPMENT INVENTORY ASSESSMENT OF CHILDREN'S DEVELOPMENT, SYMPTOMS, AND BEHAVIOR PROBLEMS

Twenty years ago the Minnesota Child Development Inventory was created (MCDI: Ireton and Thwing, 1972) to provide a systematic standardized method for obtaining parents' reports of their children's present development for children ages one to six years. Subsequent research has established the concurrent validity of the MCDI, with psychological test results, for children with developmental disabilities (Chaffee, & Cunningham, 1990; Colligan, 1977; Ireton, Thwing, & Currier, 1977), normally developing children (Gottfried & Servos, 1978), and infants and children at risk for disability (Eisert, Spector, Shankaran, Faigenbaum, & Szego, 1980; Saylor & Brandt, 1986). Other research has also established the predictive validity of MCDI results (Colligan, 1976; Colligan, 1981; Guerin & Gottfried, 1987). Test measures have included the Bayley Scales of Infant Development (Bayley, 1969), McCarthy Scales of Children's Abilities (McCarthy, 1973), Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983), Wechsler Intelligence Scale-Revised (Wechsler, 1974), and the Wide Range Achievement Test-Revised (Jastak & Wilkinson, 1984).

This paper describes the restandardization research with the MCDI, now called the Child Development Inventory (CDI: Ireton, 1992). The new CDI is the product of research and clinical experience with the MCDI and with related inventories created for narrower age groups including the Minnesota Infant Development Inventory (Ireton & Thwing, 1980), Early Child Development Inventory (Ireton, 1988), Preschool Development Inventory (Ireton, 1988), and Minnesota Prekindergarten Inventory (Ireton & Thwing, 1979). The CDI is for the assessment of children 15 months to six years of age and for older

children who are judged to be functioning in the one- to six-year range. The CDI measures the child's present development in eight areas: social, self help, gross motor, fine motor, expressive language, language comprehension, letters, and numbers. It also includes an index of overall development called the General Development Scale. The CDI goes beyond the MCDI in that it has added items to measure parent's concerns about the child's vision and hearing, health, and growth as well as development. It also includes new items to measure various behavior and emotional problems of young children.

Children's health, development, and adjustment are intimately related to each other. Illnessess such as chronic ear infections may interfere with a child's hearing, ability to attend, and language development. Chronic illnesses such as asthma may interfere with the child's ability to function and compromise their social development and other learning. Children with behavior problems, such as attention-activity level problems, or emotional problems, such as extreme shyness or fearfulness, will not be able to learn as well. The CDI provides a profile of the child's present development and possibly related symptoms and problems.

METHOD

CDI METHOD

The CDI consists of a booklet and answer sheet for the parent to complete and a Child Development Inventory Profile sheet for recording results. The CDI booklet contains 270 statements that describe developmental skills of children in the first six and one-half years of life that are observable by parents in everyday situations. These items were found, through research, to differentiate older children from younger children. The booklet also includes

30 problems items that describe various sensory, physical, motor, and language symptoms and behavior problems of young children. The symptoms and problems items were derived from previous research with the Minnesota Prekindergarten Inventory, which assesses maturity for kindergarten, and from the Preschool Development Inventory, which is a brief preschool screening measure for three- to six-year-olds. In the CDI instructions, the parent is asked to indicate those statements which describe the child's behavior by marking YES or NO on an answer sheet. Scoring the scales is done by simply counting the number of YES responses for each scale using a single scoring template. The scores for the scales are then recorded on the Child Development Inventory Profile sheet. The profile pictures the child's development in comparison to norms for children age one to six years. Reported symptoms and problems items are recorded at the foot of the CDI profile.

CDI Norm Group

The CDI was standardized on a norm sample of 568 children (281 boys, 287 girls) age one to six years. The norm sample was obtained in South Saint Paul, Minnesota. South Saint Paul is a ninety-five percent white working class community. It is located in a large metropolitan area, Minneapolis-Saint Paul, but is neither inner-city nor surburban. It is located between Saint Paul and surrounding surburbs. It is an established community that does not have extremes of wealth or poverty. The children in the public school system have an average IQ of 100 (mean eighth grade student performance on the Short Form Test of Academic Aptitude). Parents were contacted by telephone and/or mail with the assistance of South Saint Paul Schools census lists. Norm group parents' levels of education in years were: mothers (mean 13.3, SD 1.6); fathers (mean 13.5, SD 2.0).

RESULTS

CDI Norms and Profile

The Child Development Inventory Profile represents a child's scores on the CDI scales in relation to age norms. The Profile presents a concise picture of the child's present development, including strengths and weaknesses. The inventory scales and norms are represented in the columns. The name of each scale is indicated at the top and bottom of each column, starting with the Social Scale and ending with the General Development Scale. The numbers and points on each scale represent the mean number of items answered YES for children of different ages in the norm group. Age is represented on the left and right margins of the profile form. Age is in months for children under age two, and in years and months for children two and older. For example, on the Social Scale, for children age 18 months the mean score is 13; for age two years, six months the mean score is 30. Norms for the symptoms and behavior problems items are reported in the CDI Manual in terms of percentages by age and sex.

(FIGURE 1 ABOUT HERE)

This is the CDI Profile of a five year old boy. The horizontal lines are drawn at the child's age level (5-0), at 25 percent below the child's age level (3-9), and at 30 percent below age level (3-6). This child's Espressive Language and Language Comprehension scores fall clearly in the delayed range (over 30 percent below age level). The Numbers Scale score is also in the delayed range. Scores on all the other developmental scales, including the Social, Self Help, Gross Motor, Fine Motor, Letters, and General Development Scales, are within age expectations. Reported symptoms include aches and pains, "earaches-otitis media", does not talk well for age, and speech is

difficult to understand. Two behavior problems--attention-poor listener and demanding-strong-willed are also reported. This child is currently enrolled in the South Saint Paul Early Childhood/Special Education Program.

CDI Validity

The validity of the CDI was determined in a number of ways: first, by examining CDI results for norm group children at younger and older ages, second, by comparing their CDI results to psychological test results, and third, by examining CDI results for children with developmental and other problems.

Relationship To Age

The CDI is designed to measure the developmental progress of young children from infancy to school age. It is an age scale. By design, it includes items that differentiate the behavior and development of younger children from the behavior and development of older children. To be valid, the CDI scales must be sensitive to these changes that occur with age. The relationship of the CDI scales to age is shown in Table 1 in two ways: first, by the correlations of scores on the scales with age, and second, by the progression in mean scores with increasing age.

(TABLE 1 ABOUT HERE)

To be valid for identifying and assessing children with developmental problems, a developmental scale must do more than demonstrate progression in mean scores with increasing age. Also, presumably normal children, the norm group children, must score within a reasonable range around the average performance for children of their age. For example, the large majority of three-year-olds (age 3-0) must do better than the average two-year-old (age

2-1). This 30 percent below age cutoff defines a range of normal such that 98 percent of children should score above the cutoff and 2 percent should fall below the cutoff. This assumes a normal distribution. If 98 percent of norm group children score within this range, then a child who obtains scores below the 30 percent cutoff probably has a significant developmental problem.

The percentages of norm group children who obtained low scores for their age were determined. The percentage of children scoring within the 25-30 percent below age range and greater than 30 percent below age was determined. This was done for each scale and for CDI results overall by one year age groups. These results are shown in Table 2, beginning with the General Development Scale.

(TABLE 2 ABOUT HERE)

These results demonstrate that, among the norm group children, low scores for age are relatively infrequent, especially for the General Development Scale. This suggests that when a child who is being assessed for possible developmental problems obtains a CDI profile with one or more delayed scores, the child probably has a significant developmental problem.

Kindergarten Validity Study

The relationship between parents' CDI reports and children's subsequent school performance was studied for 132 kindergarten students. CDI reports obtained in the fall of the kindergarten year were compared to reading and math testing done near the end of kindergarten. Testing was done as a part of Title I program elegibility identification. The reading and math skills test is an Assessment test developed by Chapter I: First Grade Pretest based on

Macmillan Objectives Readiness Level 7. The reading and math skills test is a group-administered achievement test.

The relationship between parents' CDI reports and Reading and Math test scores are shown in Table 3.

(TABLE 3 ABOUT HERE)

The General Development Scale correlates highest with reading and math achievement, followed by the letter and number scales, then the language scales.

Early Childhood/Special Education Validity Study

South Saint Paul early childhood screening provides for early identification and early intervention for special educational needs children by outreach programs for birth to age three and by outreach/mass screening for children age three and one-half to four and one-half. There are 58 children enrolled in the South Saint Paul Early Intervention Program. CDI results were available for 26 of these children including 18 boys and eight girls. They ranged in age from two to six years. The largest number (11) were four-year-olds.

Nineteen of these 26 children (73 percent) had CDI Profiles that were delayed in one or more areas, compared to 11 percent in the norm group. Seven of the 19 CDI delayed children, had generally delayed profiles, including a General Development Scale in the delayed range. Of the seven children with normal range CDI Profiles, five had speech and language problems reported on the CDI, one was described as "severely shy", and one had juvenile rheumatoid arthritis. Among the 26 Early Childhood/Special Education children all were identified by either having a delayed CDI profile (1[illegible], or by problems reported

on the CDI (7). The CDI results for these children appear to meaningfully describe the range of these children's problems from lesser speech and language problems to severe developmental disabilities.

CHILDREN WITH HEALTH PROBLEMS

Among 24 children reported to have various health problems, 15 children suffered from chronic ear infections (otitis media), historically or presently. Of these 15 children, five were reported on the CDI to have speech and language problems, one a hearing problem, and one an attention problem. Four children suffered from asthma. The CDI Profiles of these four asthmatic children were generally within normal limits. One child, who was described as having severe asthma and a history of 13 hospitalizations in three and one-half years, had a delayed Social Scale score and three behavior problems reported: "demanding," "disobedient," and "can't sit still; may be hyperactive." While there are not enough sick children in this sample to reach meaningful conclusions about their CDI results, they are described here to highlight the importance of considering the effects of illness on the development and adjustment of young children.

Discussion

Results for the new CDI are consistent with research with the original MCDI which established correspondence between parents' MCDI reports and test results for children with and without developmental disabities. These data indicate that parents' CDI reports correlate with children's age, with children's achievement of reading and math skills in kindergarten, and are related to children's placement in early childhood/special education. The CDI results for the children in early childhood/special education describe

children with a range of problems from major general development disabilities to mild specific delays such as speech problems.

For sick children with chronic illnesses, the CDI results suggest relationships between their health problems and their development and adjustment. The CDI could provide a meaningful measurement tool in research regarding the relationships between children's health, development, and adjustment. For example, research in progress with children receiving kidney dialysis (C. Wright, personal communication, March, 1993)) and children with spina biffida (E. Hobdell, personal communication, March, 1993) will provide a clearer picture of these children's development, behavioral problems, and other symtoms.

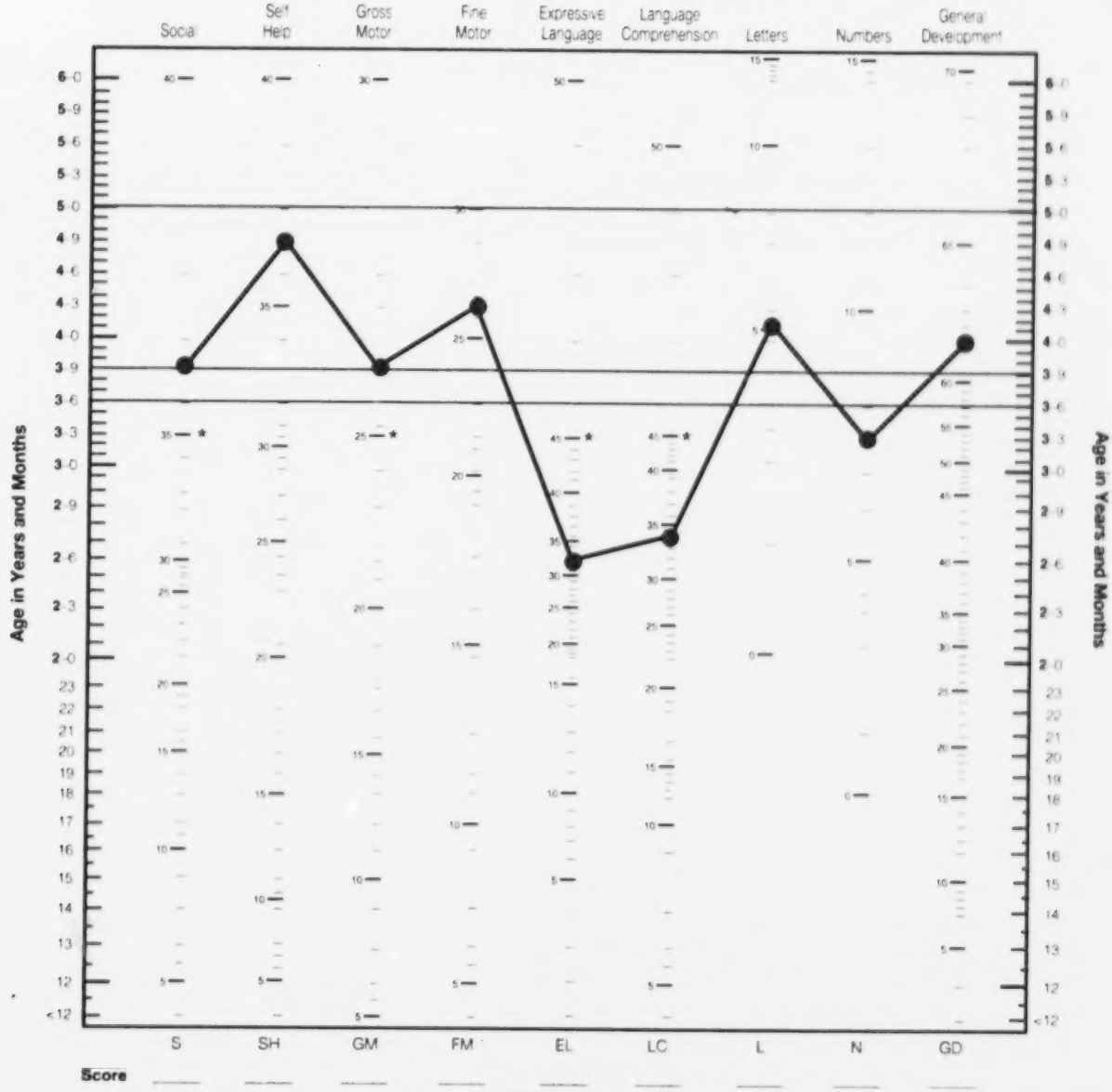
Finally, family-centered approaches to early intervention and federal mandates regarding family involvement (IFSPs) place parents at the center of the early intervention process. What better place to begin than by placing parents at the center of the assessment process? The CDI or similar instruments combined with interviews can provide the fulcrum for family involvement. Parents' observations, concerns, questions, and priorities can be more thoroughly, more systematically determined in this way. Collaboration could replace intimidation and both parents and child would benefit in the process. Professionals would also see better results for their efforts.

FIGURE 1

Child Development Inventory Profile

Name _____ Date Completed _____ Age **5-0**

Special Problems **SPEECH** _____ Birthdate _____ Sex **M**



PROBLEMS

271 Seems to have trouble seeing
272 Seems to have trouble hearing
273 Health problems
274 Growth, height, or weight problems
275 Eating problems
276 Bowel and bladder problems, toilet training
277 Sleep problems
[illegible] Aches and pains
279 Energy problems, tired and sluggish
280 Clumsy, walks or runs poorly (age 2 and older)
281 Clumsy doing things with hands
[illegible] Does not talk well for age
[illegible] Speech difficult to understand (age 3 and older)
284 Stutters or stammers
285 Does not understand well
286 Immature, acts much younger
287 Prefers to play with younger children
288 Dependent, clingy, very upset about separating
289 Passive, seldom shows initiative
[illegible] Attention, poor listener
291 Can't sit still, hyperactive?
292 Disorganized, messy, careless, irresponsible
[illegible] Demanding, strong-willed
294 Disobedient
295 Overly aggressive
296 Timid, fearful, worries a lot
297 Unhappy, cries or whines a lot
298 Seldom plays with other children
299 Lacks self-confidence
300 Other problems

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CDIarticles/P-JPP

TABLE 1

CDI Scales' Relationship to Age

Scale	Correlation[1]	Means score by age[2] 1yr	2yr	3yr	4yr	5yr	6yr
Social	.81	9	23	34	38	38	39
Self Help	.84	8	21	28	34	37	39
Gross Motor	.81	8	19	22	27	28	29
Fine Motor	.84	7	15	20	25	29	29
Expr Language	.83	4	20	43	47	48	49
Language Comp	.84	7	21	40	47	49	49
Letters	.70	0	0	2	4	8	12
Numbers	.83	0	2	7	10	11	13
Gen'l Develop	.89	5	30	50	61	66	69

[1]Pearson product-moment correlation
[2]Age intervals: 1 year (12 to 15 months), 2 year (2-0 to 2-3) etc.

TABLE 2

CDI Validity - Low Development For Age Children in the Norm Group
Percentages by Age

Scale/Age	15m-2yr	2yr	3yr	4yr	5yr
Gen. Dev.					
25-30% Below Age Range	0	1	0	0	1
>30% Below Age	0	0	1	1	2
Social					
25-30% Below Age Range	5	3	3	2	4
>30% Below Age	0	1	2	9.5	5.5
Self Help					
25-30% Below Age Range	1.5	0	0	2	2.1
>30% Below Age	1.5	3	2	3	2.5
Gross Motor					
25-30% Below Age Range	0	1	1	2	0
>30% Below Age	0	3	3	3	2
Fine Motor					
25-30% Below Age Range	2	0	2	4	0
>30% Below Age	0	3	3	1	2
Exp. Language					
25-30% Below Age Range	1.5	0	3	2	0
>30% Below Age	1.5	2	2	9.5	4
Language Comp.					
25-30% Below Age Range	3	1	2	4	0
>30% Below Age	1.5	1	1	9.5	2.5
Letters					
25-30% Below Age Range			1	1	6.5
>30% Below Age			5	10.5	2
Numbers					
25-30% Below Age Range			0	1	2.5
>30% Below			5	9.5	4
CDI Profile					
25-30% Below Age Range	11.5	5	5	5	7.5
>30% Below Age	1.5	9	10	15	11

TABLE 3

Correlations between CDI Scale Results and Achievement Test Results*
N = 132

	S	SH	GM	FM	EL	LC	L	N	GD
Reading	NS*	.35	NS	NS	.36	.42	.56	.65	.69
Math	NS	NS	NS	.31	.39	.31	.49	.55	.59

*Pearson product-moment correlation - NS = Not significant: There is no point in reporting numbers for correlations that are not significant

APPENDIX

CHILD DEVELOPMENT INVENTORIES - DESCRIPTIONS, RESEARCH, AND REFERENCES

The original MCDI was published in 1972. This was followed by the Minnesota Prekindergarten Inventory (1979), which is for assessment of kindergarten readiness. Next came the Minnesota Infant Development Inventory (1980), for reviewing the development of infants in the first fifteen months. Two early childhood/preschool screening measures were then created: The Preschool Development Inventory (1987) and the Early Child Development Inventory (1988). The Child Development Review-Parent Interview (1990) was then created to provide and alternative to the inventory format.

Following are descriptions of the instruments and research related to them. Finally, there is a list of references describing published research with the Child Development Inventories, beginning with the MCDI. Not included are numerous graduate student theses.

Minnesota PreKindergarten Inventory (age 4 1/2 to Kindergarten) (Ireton & Thwing. 1979).

The MPI is a kindergarten readiness measure. It provides detailed information about the child's development, academic readiness skills, adjustment, and various symptoms. The MPI consists of an inventory booklet and answer sheet for the parent, a manual, a set of scoring templates and an MPI Profile for recording results. The MPI booklet contains 150 items, including 90 developmental items, and 60 items measuring behavior problems and various symptoms. The developmental scales, adjustment scales, and symptoms clusters are outlined below.

Development:	Self Help, Fine Motor, Expressive Language, Comprehension, Memory, Letters, Numbers
Adjustment:	Immaturity, Hyperactivity, Behavior Problems, Emotional Problems
Symptoms:	Motor, Language, Somatic, Sensory

Interpretation: The child's score on each scale is represented as a percentile for the total prekindergarten age group. In this way, a child whose development falls in the bottom five to ten percent among his or her potential kindergarten classmates can be identified.

Research: The MPI's validity as a kindergarten readiness measure has been studied by comparing mothers' prekindergarten MPI results with kindergarten teachers' ratings of students' performance at year's end (Ireton, Lun & Kampen, 1981). First norms were established for 360 white children age four and one-half to five and one-half from Bloomington, Minnesota. Then children falling in the extreme five percent on any of the development or adjustment scales were identified. Among poorly performing kindergarten students, 60 percent were identified by low scores on the developmental scales. The adjustment scales were not predictive of poor kindergarten performance. If children had extreme behavior problems scores, but had good development, these children did well enough in kindergarten. Among children with normal range developmental scores, ninety-seven percent were classified by teachers as performing adequately in kindergarten.

Minnesota Infant Development Inventory (Birth to 15 Months) (Ireton and Thwing, 1980).

The MIDI measures infant development in five areas: gross motor, fine motor, language, comprehension, and personal-social. The MIDI booklet includes one item per month of age in each area of development, which provides a developmental map for the first fifteen months. The mother answers YES or NO to each item to describe her baby's present development. She is also asked to describe her child briefly and to report any problems or concerns. The MIDI may also be used as an observation guide by the professional, or as an interview guide for parent's who have difficulty completing a questionnaire.

Interpretation: The child's level of development in each area is compared to the child's actual age. Below age guidelines are provided to identify infants whose development is possibly delayed. The MIDI items and the results for a particular child may also be used as a parent education tool - "These are the things that children do in the first fifteen months."

Research: The MIDI items were drawn from earlier research with the Minnesota Child Development Inventory. Developmental age norms have been established for these items. One study (Creighton and Sauve, 1988) compared MIDI results to Bayley Mental Scale scores for a sample of high risk eight-month olds (N-86). Results on each measure, classified as delayed or not delayed, showed good overall agreement (81 percent to 90 percent). The MIDI demonstrated good sensitivity (85 percent) in detecting delay and fair specificity (77 percent) in identifying normal development.

Early Child Development Inventory (Age 15 months to 3 years) (Ireton, 1988).

The ECDI, a brief screening measure, consists of a one-page two-sided questionnaire for the parent and a brief manual for the professional. The questionnaire is divided into six sections:

1) **General Development Scale:** a 60-item measure of the child's overall development. These items describe motor, language, self-help, and social skills.

2) **Possible Problems List:** 24 items that describe various symptoms and behavior problems.

3) **Child Description:** parent's brief description of the child.

4) **Special Problems or Handicaps:** parent's report of problems that may be major handicaps or obstacles to learning.

5) **Questions or Concerns:** parent's report of concerns, or simply questions they have about their child.

6) **Parent Status:** "How are you doing, as a parent and otherwise, at this time?"

Interpretation: Results for each section of the ECDI are classified as 1) showing no evidence of any problems, 2) raising concern about a possible problem, or 3) suggesting a possible major problem. Collectively, they provide measures of the child's overall development, possible problems, the parent's concerns, and most important, indicators of the need for followup evaluation.

Research: The General Development Scale total score is highly age discriminating, that is, the score is highly correlated with age (r=.92) (Colligan, 1977). A low score on the General Development Scale is very predictive of a significant developmental problem (90 percent) (Ireton, Thwing & Currier, 1977). The accuracy of the possible problems items for the identification of current problems has not yet been studied. Questions three to six are used as additional information beyond the standardized data obtained by the General Development Scale and problems list.

Preschool Development Inventory (Age 3-0 to Kindergarten) (Ireton, 1987).

The format of the PDI is the same as the ECDI. The PDI General Development Scale items are motor, language, self-help, and social behaviors that are appropriate to the three to five year age range. The possible problems items are similar to the ECDI problems items.

Interpretation: Results are classified in the same fashion as with the ECDI: 1) No apparent problem, 2) possible problem, 3) possible major problem.

Research: The PDI's validity for preschool screening has been studied with a sample of three- and four-year-old children (N=220). These children were screened in the spring, 16 months prior to kindergarten entry, to allow time for early intervention. The PDI sample was obtained in South St. Paul, Minnesota.

The screening includes health history from the parent, vision and hearing check, and brief developmental testing with the Developmental Indicators for the Assessment of Learning (DIAL). For this study, parents were also asked to complete the PDI at home and bring it to the screening. Referral decisions were based primarily on direct evaluation results, with the parents' PDI results used in a supplementary fashion. Twenty-four percent of the 220 children (N=53) were referred for followup assessment. Twenty-five children (11 percent) were provided with preschool special education services. About two years later, at the end of the kindergarten year, teachers rated all their students' performance.

On the PDI, the 25 children referred for preschool special education services more commonly showed below average general development scores than non-referred children (40 percent versus 7 percent) and also had more possible problems (44 percent versus 10 percent). Overall PDI results yielded a sensitivity of .68 and specificity of .88 (68 percent of referred children had PDIs with major problems, while 88 percent of non-referred children had PDIs that were normal range).

Some PDI measures predicted kindergarten performance two years later. Low scores on the General Developmental Scale (bottom 10 percent) are associated with a 90 percent change of poor or below average performance in kindergarten. High numbers of possible problems items (8 or more—extreme 5 percent) are also predictive. All these children were poor or below average students. Certain individual problems items were also predictive. These include: "talks only in short phrases", "has trouble expressing ideas", "slow to catch on—does not comprehend well", and "immature: acts much younger than age." Among kindergarten children for whom parents' prior PDI reports had indicated no problems of any kind, 82 percent were doing well (average or above) in kindergarten.